The STORY OF SLATE

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The Story of Slate

TO UNDERSTAND slate properly one must know something of its origin and must be able to follow in some measure the slow but powerful geologic forces that have shaped it into its present form.

The natural history of slate falls into two great periods, each period covering thousands and possibly millions of years.

The *first period* has to do with the *origin* of the mineral particles of which slate is formed.

All rocks slowly wear away and disintegrate through the action of frost and water.

Sometimes fiction writers, orators or poets speak of the everlasting hills—but no hills are everlasting—the rocks that form them are slowly but continuously changing into new forms that are carried away and are built up into other rocks.

Many minerals, particularly the feldspars, slowly change into clay and this clay is washed down by the rain, carried by streams into rivers, and by rivers to the sea.

Clay particles are very small and light, so are carried far from shore and deposited in uniform beds on the ocean floor.

Such clay beds are the raw materials from which slate is produced by the forces of nature.

THE *second great period* comprises the centuries during which the unseen forces of nature convert the clay into slate as we now find it in the earth.

The clay beds are first compressed into a firm mass known as shale.

The shales may later be intensely folded and squeezed.

It is generally assumed that the earth is slowly cooling, and as it cools, it shrinks.

This shrinkage causes a wrinkling or folding of the surface rocks just as the skin of an apple wrinkles when it is baked.

When the shales are caught in these folds they are squeezed with terrific force and under high temperature.

The forces are so great that in some mysterious manner the clay is converted into new minerals, the chief of which are mica and chlorite, both consisting of minute flakes and scales.

Millions of these tiny flakes overlap each other like shingles on a roof.

As they all lie in one plane there is developed a remarkable tendency for the rock to split with great ease in one direction.

This splitting tendency or cleavage is the most important property of slate.

Slabs 4 x 6 feet in size, or larger, may be readily split to less than ½-inch thick, and there have been instances where sheets 8 x 16 inches have been split to the remarkable thinness of $\frac{1}{64}$-inch.

The little tabular or flake-like grains are cemented under intense pressure which gives slate unusual strength.

While human hands can take slate apart they can never put the grains together again with the same regularity, nor can they give it the same strength as is possessed by the natural rock.

The fineness of grain, uniformity and strength of slate fit it peculiarly well for many purposes.

Remember now that no rocks are everlasting and slate is no exception to this rule.

It is noteworthy, however, that slate consists of non-metallic minerals that are very enduring and that resist remarkably well the forces of the weather that are ever at work in wearing down the rocks.

Now what are some of the uses for which this remarkable product is best adapted?

Its enduring properties and its tendency to split into thin sheets led to its early use for making weatherproof roofing for houses, and this is still one of its important uses.

Black, gray, green, red, purple or mottled slates form many of the most beautiful roofs to be found in the world.

It has also been found that high-grade slate is an excellent nonconductor of electricity, and as it can be readily shaped, drilled and polished, it is widely used for electrical switchboards.

Engineers in power-houses and factories take great pride in the attractive appearance of the large switchboards which form an important part of the equipment wherever electricity is generated or used.

Slate slabs are attractive, and as they are easily matched in color a slate switchboard may be enlarged without detracting from its appearance.

THE roof is not the only part of a building in which slate is widely used.

It may be seen in many buildings in the form of stair steps, baseboards, window sills, shower stalls, floor tile, etc.

It is also fashioned into laundry tubs, water tanks, kitchen sinks, dough troughs in bakeries and similar furnishings.

You are all familiar with slate in the form of blackboards, a use for which it excels all other materials.

It is claimed that one area in Pennsylvania, 26 miles long and 2 or 3 miles wide, provides most of the blackboard slate in the world.

Our grandparents used school slates, but they have been largely replaced in the United States by exercise books, more commonly, and I hope incorrectly, called "scribbling books."

School slates are still manufactured in great quantities, but about 90 percent of them are exported to foreign lands.

YOU have now had a brief outline of the origin and history of slate and its chief uses.

Let us turn to a natural ledge of slate rock as it lies in the mountain side, and follow each step in the process of shaping it into finished forms.

Slate occurs in many parts of the country and is worked chiefly in the states of Pennsylvania, New York, Vermont, Maine, Maryland and Virginia.

When a deposit of good slate is found the chief task is to remove all the soil or inferior rock from the surface leaving the good slate exposed.

The slate may be removed by blasting in drill holes, but many operators now use channeling machines to cut out massive blocks.

A channeler is a machine operated by steam or compressed air that chops the rock by repeated blows of heavy chisel-like bars.

In this way a vertical channel or groove 2 or 3 inches wide and possibly 12 feet deep is cut along the wall of the quarry, and cross channels subdivide the rock into large rectangular masses.

The latter are broken free from the quarry floor by driving wedges in drill holes or by the discharge of a small amount of black blasting powder.

The large masses are subdivided by splitting along the direction of slaty cleavage and by making fractures in other directions with wedges driven into drill holes.

Masses of slate thus obtained weighing 1 to 3 tons are hoisted to the surface.

Great chains are placed about them and they are elevated with steel cables wound on drums by powerful hoist engines.

Some slate quarries have been worked for many years and thus are of wide extent and very deep.

Several of the Pennsylvania quarries are more than 400 feet in depth.

THE treatment that a block of slate receives after it is removed from the quarry depends entirely on the purpose for which it is to be used.

If it is to be converted into roofing slates the process is very simple.

The block is first subdivided into masses 24 to 30 inches in length and the thickness of 8 slates.

This is the task of the block-maker.

The splitter then takes these masses and with a thin flexible steel chisel and a wooden mallet he subdivides each block, always splitting it in the center, until the 8 slates are obtained.

The trimmer then places them on a trimming machine where the irregular edges are cut away leaving the largest perfect rectangle of a given standard size that the slab will make.

Trimming is done with a heavy blade like a great meat cleaver, operated with a foot treadle, or sometimes with a curved rotating blade like that of a lawn mower.

The finished slates are piled in racks according to size, and when holes are punched in them for nailing they are ready to be placed on a roof.

Slate used for other purposes is usually termed "structural slate" or "milled stock."

Mills equipped with various machines are required for the manufacture of structural slate products.

The first milling process is most surprising.

You have all at some time or other observed a circular saw cutting logs into lumber or boards into shorter pieces.

You may have wondered at the ease with which a circular saw eats its way through a hard piece of timber, but it seems even more remarkable that a circular saw can be used to cut a piece of rock.

Such is the case, however, for the first operation in the mill is to place the block of slate on a heavy traveling bed that carries it against the teeth of an especially designed circular saw.

The bed travels very slowly, and the saw rotates at much slower speed than a wood saw, but a mass of slate 1 foot thick and 4 feet wide may be cut across in a very few minutes.

The blocks obtained may be split to the desired thickness for blackboards.

If structural slabs are desired the blocks are placed on a second traveling bed and passed repeatedly beneath a heavy blade which scrapes the surface smooth. This machine is called a "planer."

The surfaces may be sand-rubbed and polished by other machines.

Edges may be trimmed or bevels cut with carborundum wheels.

In a properly arranged slate mill the rough block enters at one end and passes from one machine to another in a regular order until it is prepared for shipment.

An interesting feature of slate-working is the importance of keeping the block moist until final splitting is accomplished.

As the block lies in its natural bed it contains what is called "quarry water."

If this water once dries out, the slate will not split readily, and no amount of wetting will renew the splitting property if once it is lost.

All quarry blocks are conveyed directly to the mill, and if there is any long delay water is thrown over them or they are covered to prevent evaporation.

Only the highest quality of slate is used for the manufacture of slate products, and all defective blocks are thrown away.

Thus great mountains of waste are built up around slate quarries, and one of the big problems in the industry is to find uses for this waste material.

Some of it is ground to a fine dust and mixed with asphalt for making roads. It is also used in such products as floor linoleum, rubber and paint.

From the brief historical outline presented you will appreciate that slate is a remarkable material which nature has endowed with peculiar and valuable properties.

This short description of uses and processes shows you that man has invented methods whereby these unusual properties may be turned to practical use with the result that slate furnishes many useful products which contribute to comfort and convenience.

Sometimes on foggy mornings objects appear with dim outlines, and with difficulty we distinguish a house from a tree.

We see, but our vision is not clear.

On the other hand we sometimes see objects plainly in so far as our actual eyesight is concerned, but the object conveys little impression to our minds because it is not understood—our lack of information about the object covers it like a fog, and we see only its outlines.

Possibly with most of you slate is one of those objects which you see with the eye only, and this short story will have served its purpose if it clears away the fog in some measure and enables you, when you see slate with the eye, to see it also with the understanding.